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Tipo de entrenamiento y momento de elaboración de descripciones poscontacto contingencial en tareas de igualación de la muestra

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Resumen

En el presente trabajo se evaluó el efecto de distintos tipos de entrenamiento sobre (a) la ejecución en pruebas de aprendizaje y transferencia, y (b) la elaboración de descripciones poscontacto en una tarea de discriminación condicional de segundo orden. Con este fin, se asignaron 16 participantes a cuatro grupos; la fase de entrenamiento para los grupos 1 y 3 consistió en la observación de una tarea de discriminación condicional de segundo orden en la que las respuestas de igualación fueron resaltadas con un marco rojo y se indicó, para cada ensayo, si eran acertadas o erróneas (entrenamiento observacional), mientras que para los participantes de los grupos 2 y 4 la tarea consistió en emitir una respuesta explícita de igualación ensayo por ensayo (entrenamiento instrumental). Adicionalmente, se le pidió a los participantes de los grupos 3 y 4 que realizaran una descripción de las contingencias enfrentadas cada doce ensayos, y al finalizar la tarea completa se le pidió a todos los participantes que elaboraran una descripción similar. Como resultado, los participantes de los grupos que estuvieron bajo entrenamiento observacional presentaron el mayor porcentaje de aciertos en las pruebas de aprendizaje y transferencia, además de que elaboraron descripciones poscontacto más específicas y pertinentes que los individuos de los grupos restantes. Estos resultados sugieren que el aprendizaje mediante la observación puede darse incluso si el observador no es expuesto directamente a la ejecución de la respuesta de otro individuo, es decir, aun cuando las respuestas reforzadas se presenten solo de manera gráfica.
Palabras clave: entrenamiento observacional, entrenamiento instrumental, descripciones poscontacto, reglas, igualación de la muestra de segundo orden.

Training type and moment of elaboration of post-contact descriptions in a matching-to-sample task

Abstract

The effects of different types of training over a) performance on learning and transfer tasks, and b) generation of post-contact descriptions in a second order matching-to-sample task were assessed. 16 participants were randomly assigned to one of four experimental groups. During the training phase, the requirement for participants in groups 1 and 3 consisted of the observation of a conditional discrimination task in which matching responses were highlighted with a red frame and indicated, for each trial, whether they were right or wrong (observational training). During this same phase, the task for participants in groups 2 and 4 was to produce, trial by trial, an explicit matching response (instrumental training). Additionally, participants in groups 3 and 4 were required to write a description of the contingencies every twelve trials. After the task, all participants were requested to develop a similar description. Participants of groups that were under observational training had the highest percentage of correct answers on learning and transfer tests. Similarly, they produced more specific rules than individuals from other groups. These results suggest that learning by observation can occur even if the viewer is not directly exposed to responses of another individual, that is, even when reinforced responses are simply presented graphically.
Keywords: observational training, instrumental training, postcontact descriptions, rules, second order matching-to-sample task.

Tipo de treinamento e momento de elaboração de descrições pós-contato contingencial em tarefas de igualação da amostra

Resumo

Neste trabalho, foi avaliado o efeito de diferentes tipos de treinamento sobre a execução em testes de aprendizagem e transferência e a elaboração de descrições pós-contato numa tarefa de discriminação condicional de segunda ordem. Com esse objetivo, foram designados 16 participantes a quatro grupos. A fase de treinamento para os participantes dos grupos 1 e 3 consistiu na observação de uma tarefa de discriminação condicional de segunda ordem na qual as respostas de igualação foram ressaltadas com um sinal vermelho e foi indicado, para cada ensaio, se eram acertadas ou errôneas (treinamento observacional). Nessa mesma fase, para os participantes dos grupos 2 e 4, a tarefa consistiu em emitir uma resposta explícita de igualação ensaio por ensaio (treinamento instrumental). Além disso, foi pedido aos participantes dos grupos 3 e 4 que realizassem uma descrição das contingências enfrentadas a cada doze ensaios. Ao finalizar a tarefa, foi solicitado a todos os participantes que elaborassem uma descrição semelhante. Como resultado, os participantes dos grupos que estiveram sob o treinamento observacional apresentaram maior porcentagem de acertos nos testes de aprendizagem e transferência, e elaboraram descrições pós-contato mais específicas e pertinentes do que os indivíduos dos demais grupos. Esses resultados sugerem que a aprendizagem mediante a observação pode acontecer inclusive se o observador não for exposto diretamente à execução da resposta de outro indivíduo, isto é, ainda quando as respostas reforçadas forem apresentadas somente de maneira gráfica.
Palavras-chave: treinamento observacional, treinamento instrumental, descrições pós-contato, regras, igualação da amostra de segunda ordem.

Introduction

Several authors have emphasized the importance that verbal descriptions of contingencies (i.e., contingency arrangement, objects, persons, consequences and dependence relationships that form a situation when settling down) can have for behavior (e.g., Baron, Kaufman, & Stauber, 1969; Danforth, Chase, Dolan & Joyce, 1990; Galizio, 1979). Thus, it has been found that when individuals receive descriptions prior to exposure to different tasks, as instructions, they tend to adjust more quickly to the specified contingencies even without having had direct contact with them in previous occasions (e.g., Baumann, Abreu-Rodrigues & Souza, 2009; LeFrancois, Chase & Joyce, 1988; González & Ortiz, 2014). The control exerted by descriptions on behavior could be considered as a case of indirect control, since it is not necessary for the subject to experience the consequences of his own behavior in order to adjust to the dependency relationships referred to in a description. Generally, such verbal descriptions have been called, sometimes without distinction, as rules or instructions (e.g., Andronis, 1991; Baron & Galizio, 1983; Blakely & Schlinger, 1987; Cerutti, 1989; Hayes, 1986; Peláez & Moreno, 1998; Rosenfarb, Newland, Brannon & Howey, 1992; Skinner, 1966; Vaughan, 1989).

According to diverse authors (e.g. Ribes, 2000; Ortiz, González & Rosas, 2008), instructions and rules are two different functions that the descriptions of contingencies can acquire. If the description of the contingency (i. e., accounts for the situation/task to be solved) is given before facing the situation and its effect is to reduce the range of possible responses in the situation described/faced, then it would be stated that this pre-contact description acquired an instructional function (i.e., become an instruction). Also, it is possible that those individuals who have been able to cope with a situation/task can verbally describe the contingencies to which they were exposed, abstracting (i.e., identifying) certain elements of the situation faced. Eventually, this post-contact description generated by the individual facing the situation/task and followed in a different moment or situation by the same or a different individual, would become a rule whenever it is used as a pre-contact description in a similar situation and fulfills its instructional function (Ortiz, González & Rosas, 2008).

Under this logic, a large amount of research has been carried out in which a series of variables that could affect the formulation of contingent post-contact descriptions (i.e., rules) have been identified; thus, the different conditions of exposure to contingencies, the frequency of feedback, the accuracy of the pre-contact descriptions used, the moment in which the post-contact description is requested, among

others, constitute some of the factors that have been recognized as relevant in this area (e.g., Ortiz & Cruz-Alaniz, 2011; Ortiz & González, 2010a; Ortiz, González, Rosas & Alcaraz, 2006; Vega & Peña, 2008; González & Ortiz, 2014; Silva, Cisneros & Ortiz, 2014).

An important aspect regarding the acquisition of a rule function by the post-contact description is that it is used at a later time by the same individual who formulated it or by another individual(s) as an instruction (i.e., pre-contact description with an instructional function), thus facilitating the individual adjustment to novel situations. In this sense, although a post-contact description includes elements identified as relevant by the person who confronted the situation (i.e., abstraction), it will acquire its rule function until it is used as a pre-contact description, and in fact, acquiring an instructional function for the individual to whom it is presented (i.e., reducing the possible range of responses in the situation described). Thus far, it could be considered that both, instructions and rules imply, at least at some point in the case of rules, indirect control over contingencies.

Behavior under the control of descriptions (pre and/or post contingency contact) is not the only case of indirect control by the contingencies. It is possible that indirect contact with the consequences by observing the execution of others could derive in the learning of the dependency relationships involved in a situation and, therefore, in the acquisition of new behavioral repertoires. These changes have been classified as observational learning (e.g. Catania, 2007), and have important implications for the behavior of individuals since they allow naïve subjects to make contact with contingencies through the experience of others, thus avoiding possible aversive consequences or facilitating the encounter with appetitive contingencies that could favor survival. In functional terms, they could be similar to what has been described as instructional control (e.g., Baron & Galizio, 1983; Galizio 1979), that is, the acquisition of an instructional function by pre-contact contingential descriptions (Ortiz, González & Roses, 2008).

In several studies, evidence of observational learning has been found; for example, Rehfeldt, Latimore and Stromer (2003) found that children with autism learned conditional discriminations by observing the correct performances of a demonstrator. In a study conducted by Vega and Peña (2008), participants were exposed indirectly to the contingencies of a matching-to-sample task, either by observing the performance of an apprentice model (i.e., an experimental naïve individual in the matching-to-sample task) or by observing an expert model (i.e., performance of an individual who responded correctly during the whole task). The authors reported that although in these cases there was no direct contact with the contingencies, both trainings

seemed to facilitate transfer performance as well as the formulation of verbal rules. Additionally, they suggested that some types of observational training could serve as a type of instruction that restricts the range of responses by teaching the individual how to respond correctly and, therefore, allow him to increase the chances of adjusting to a contingency situation.

Ribes and Castillo (1998), on the other hand, found that after an observational training in a second order matching-to-sample task in which written information was provided about the correct option, but no explicit matching response was requested, the participants were able to identify, through verbal responses, the correct relations in the post-test phase as well as in the extra-modal and intra-modal transfer.

It is possible, then, that both, the direct contact with the situation (i.e., instrumental performance) and the observation of contingencies (i.e., events, consequences and dependency relationships that are structured to form a situation) that affect the performance of other individuals in a task, may have an effect on the learning of such contingencies; it is even plausible that the mere observation of the relationships between the components of a contingency (i.e., the relationship between a discriminative stimulus, the response and its consequence), can facilitate both, the subsequent adjustment to similar contingencies and the accuracy and relevance of verbal post-contact descriptions (i.e., abstraction of relevant elements to adjust to the situation).

Thus, the present study was designed to assess the effects on learning of: a) the type of training (i.e., observational or instrumental) and b) the frequency of requesting the elaboration of post-contact descriptions during training (i.e., percentage of correct answers in training conditions), transfer (i.e., percentage of correct answers in tests) and the type of post-contact descriptions (i.e., specificity and pertinence) made by the participant, in a second order matching-to-sample task.

Method

Participants

By means of an intentional non-probabilistic sampling, 16 under-graduate students aged 18 to 27- years-old, without experience in matching-to-sample tasks participated voluntarily. Nine participants were students who received academic credits for their collaboration and seven had recently graduated from this academic level. In total 30 people took part in the study, fourteen of which obtained scores higher than 50% in the pre-test session, so they ended their participation at that stage of the experiment.

Experimental scenario

All the experimental sessions were carried out in cubicles located within the facilities of the Center for Studies and Research in Behavior of the University of Guadalajara-México. Each cubicle had a dimension of 2m long by 1.5m wide, had artificial and natural lighting and was equipped with a desk and chair, as well as a commercial PC, placed on the desk.

Materials and Instruments

For the presentation of the experimental task, Lenovo® personal desktop computers with an i3 processor were used. The programming of the stimuli, the application of the experimental task and the gathering of the subjects' responses were carried out through the Authorware 7.0 program based on the task used by Quiroga (2008).

Experimental task

A second order matching-to-sample task was used, divided into four phases: pre-test, training, learning and transfer (i.e. three transfer tests, extra-instance, extra-modal and extra-relational). Each trial of the task in the different phases was composed of two selector stimuli (ES's) located at the top of the screen, a sample stimulus (EM) located in the central part and three comparative stimuli (ECo's) arranged horizontally in the bottom.

The figures used in the pre-test, training, learning and extra-relational transfer (ER) phases were triangles, squares and circles, yellow, blue and red. For the extra-instance transfer test (EI) trapezoids, rectangles and rhombuses were used, in fuchsia, green and pink colors. Finally, for the extra-modal transfer test (EM) the figures used were always circles of different textures and sizes. The second-order stimuli for all experiment phases were regular brown and purple crosses and pentagons. The matching criteria

trained and assessed were similarity and identity with the exception of the extra-relational test where the criterion indicated by the second-order stimuli was that of oddity (see Table 1).

In this way, the correct matching responses were considered those that met those criteria. For example, if the matching criterion in operation in the trial (indicated by the ES's) was similarity, the answer would be considered correct if the chosen ECo shared a modal property, but not all with the MS (i.e., same form, but different color, same color but different shape, among others, depending on the case). If, on the other hand, the criterion relation was identity, the ECo considered correct would be the one with the same modal properties to the EM (i.e. same form and color or same filling and size, according to the test).

Design

An intrasubject-intergroup comparison study was used, with pre- and post-test (i.e., learning test). The participants were randomly assigned to one of four groups (see Table 2); all the participants faced a pre-test session, three training sessions, a learning test session and three sessions with different type of transfer.

The difference between groups was based on the type of training received, resulting from the combination of the values of the training type variables (i.e., observational vs. instrumental) and the frequency of the post-contact description (i.e., once per session vs. twice per session). Thus, while groups 1 and 3 received observational training, groups 2 and 4 faced instrumental training. At the same time, the participants of groups 1 and 2 were asked for the post-contact description only once at the end of each session (i.e., after 24 trials), while the participants in groups 3 and 4 were asked for such a post-contact description twice during each session (i.e. every 12 trials).

Table 1.
Used stimuli (i.e., shapes and colors) and matching criteria

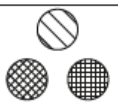
				Transfer Test		
	Pre- test	Training	Learning test	Extra-Instance	Extra-Modal	Extra-Relational
Selector Stimuli						
Sample and Comparative Stimuli						
Characteristics	Yellow, blue and red			Green, fucsia and pink	Big, medium and small	Yellow, blue and red
Matching criteria	Identity and similarity			Identity and similarity	Identity and similarity	Oddity

Table 2.
Groups and experimental conditions

Group (n= 4)		Training	Transfer tests			
1	Pre-test	Observational description end sessions	Learning test	Extra-Instance	Extra-Modal	Extra-Relational
2		Instrumental description end sessions				
3		Observational description each 12 trials				
4		Instrumental description each 12 trials				
Trials	24	72	24	24	24	24
Sessions	1	3	1	1	1	1

Procedure

Each subject was invited to enter the experimental cubicle and sit in front of the monitor. They were informed that it was a study on general learning processes and that it was not an intelligence test. The pre-contact description (i.e., instructions) for the beginning of the test (pre-test) were the same for all groups:

> "Six figures will appear on the screen: two above, one in the center and three below. You must choose one of the figures below, by clicking on it.
> The goal is to achieve as many correct responses as possible. If you have any questions ask at this time, because later we will not be able to provide you additional information."

Pre-test. All subjects were exposed to the pre-test phase, which consisted of 24 trials. During this phase, the matching criteria were both identity and similarity and there was no feedback. The requirement to move to the training block, and continue with the study, was a performance below 50% of correct responses, because a higher performance

could suggest that the participants were familiar with the task and could, therefore, solve it properly without training.

Training phase. This phase was divided into three blocks of 24 trials each and was different for each of the groups. During this phase, for groups 1 and 3 the training consisted of observing a second order matching-to-sample task in which both, the stimulus sample and one of the comparatives, were framed in red, simulating the choice of a pilot participant with a percentage of correct responses of 45.8, 66.6 and 91.6 for the first, second and third block of tests respectively; it displayed continuous feedback, showing in each trial, whether the choice was correct or incorrect. In this way, participants were exposed to both correct and incorrect answers; an explicit matching response was not required (see Figure 1).

For these two groups the instructions that preceded (i.e., pre-contact descriptions) the training trials were as follows:

"In the following slides you will see a task performed by another person. The answers given by that person have been highlighted, and, for each answer, it is

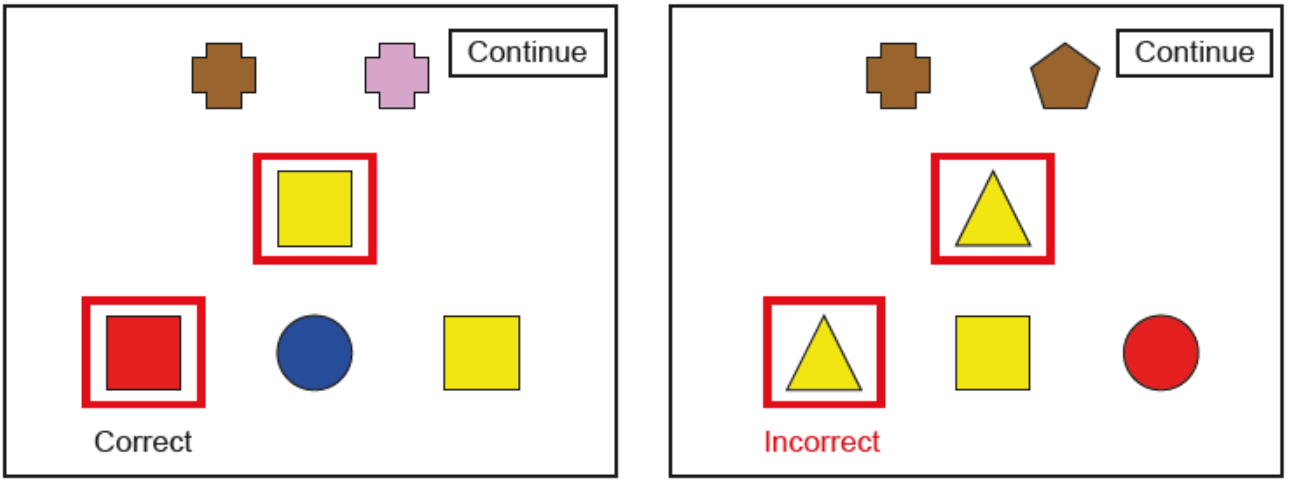


Figure 1. Examples of observational training screens.

indicated if it was correct or incorrect. Try to see why these responses were rated as correct or incorrect.
If you have any questions, please do them now, because later we will not be able to provide you with additional information."

At the same time, each participant was asked to write down the criteria under which he believed the task he had observed had been carried out. For participants in Group 1, the request was made only at the end of the transfer tests, while for participants in Group 3 the indication was also made every 12 trials during training. In this case, the instructions were as follows:

"Using the keyboard, describe the criteria or strategy that the person who solved the task had to follow to perform it correctly."

For the participants in groups 2 and 4, the training phase consisted of a second order matching-to-sample task in which an explicit matching response was requested (i.e., instrumental training). During each trial, when the performance was correct (i.e., to select the ECo that corresponded to the Em from the relationship of similarity in shape or color shown by the ES's), a sign with the word "Correct" appeared on the screen; otherwise, a sign with the word "Error" was displayed. The instructions for these groups were the following:

"Six figures will appear on the screen: two above, one in the center and three below. You must choose, by clicking with the mouse on one of the figures below that is related to the one in the center, according to what is indicated above. The goal is to achieve as many successes as possible.
If you have any questions, do them at this time, because later we will not be able to provide you with additional information."

As for the groups described above, participants were asked to write the criteria under which they had performed the task. For Group 2 this request was made at the end of the transfer tests, while for Group 4 the indication was given, in addition, every 12 tests. In this case, the instructions were:

"Using the keyboard, describe the criteria or strategy that you took into account to perform the task. "

Learning and Transfer Tests. The learning and transfer phases were the same for all participants. The learning session consisted of 24 trials and the response criteria were identity and similarity. The participants did not receive any information about whether their selections had been correct or wrong.

In the transfer test phase, three different tests were carried out (Varela & Quintana, 1995): a) extra-instance, in which the shapes and colors of the figures used in training were modified, while the modality (shape and color) and

the relation (identity and similarity) considered correct remained constant; b) extra-modal, in which the properties of the stimuli before which the choice was reinforced during training (color and shape) changed (i.e., during this test the properties before which the choice was reinforced were filling and size), whereas reinforced relationships (identity and similarity) remained constant. Finally, c) extra-relational, in which the reinforced relationship during training was varied (i.e., in this test the ECo was reinforced differently from the MS) but the shape and color of the figures used were kept constant. Each of these tests was composed of 24 trials (see Table 2). As in the learning test, no feedback was provided.

Results

Figure 2 shows the percentages of correct responses per group in each of the sessions of the study. The gray bars represent the average percentage of guesses in the pre-test and learning test, while the points indicate the results in the training sessions and the black bars the data in the transfer tests. As can be observed, the participants of Groups 2 and 4 had percentages of correct answers below 50% in each of the three blocks that formed the training.

In the learning test, for Groups 1 and 3 a performance higher than 80% of correct responses can be observed, while the participants of groups 2 and 4 continued to perform below 50%; in fact, it was the subjects of Group 4 (instrumental-description with 12 trials) who had the lowest performances in the learning test.

In the three transfer tests, participants of Group 3 (observation-description every 12 trials) achieved the highest percentage of correct responses, reaching 97% in the extra-instance test, 93% in the extra-modal test and 86% in the extra-relational test.

In these three transfer tests, participants of Group 1 (observation) achieved 78% correct answers in the extra-instance test, 70% in the extra-modal test and a performance above 80% in the extra-relational test. Participants of Group 2 (instrumental-final description) had performances that reached 50% of correct answers in the extra-instance transfer test; in the extra-modal test they barely exceeded this percentage of correct responses and in the extra-relational test they remained below this percentage. Finally, the subjects of Group 4 responded below 50% of correct responses in the three transfer tests.

Figure 3 shows individual performances in terms of the percentage of correct responses obtained in each phase of the study (i.e., correct responses with respect to the total of tests per session). Regarding the learning tests, participants 1,

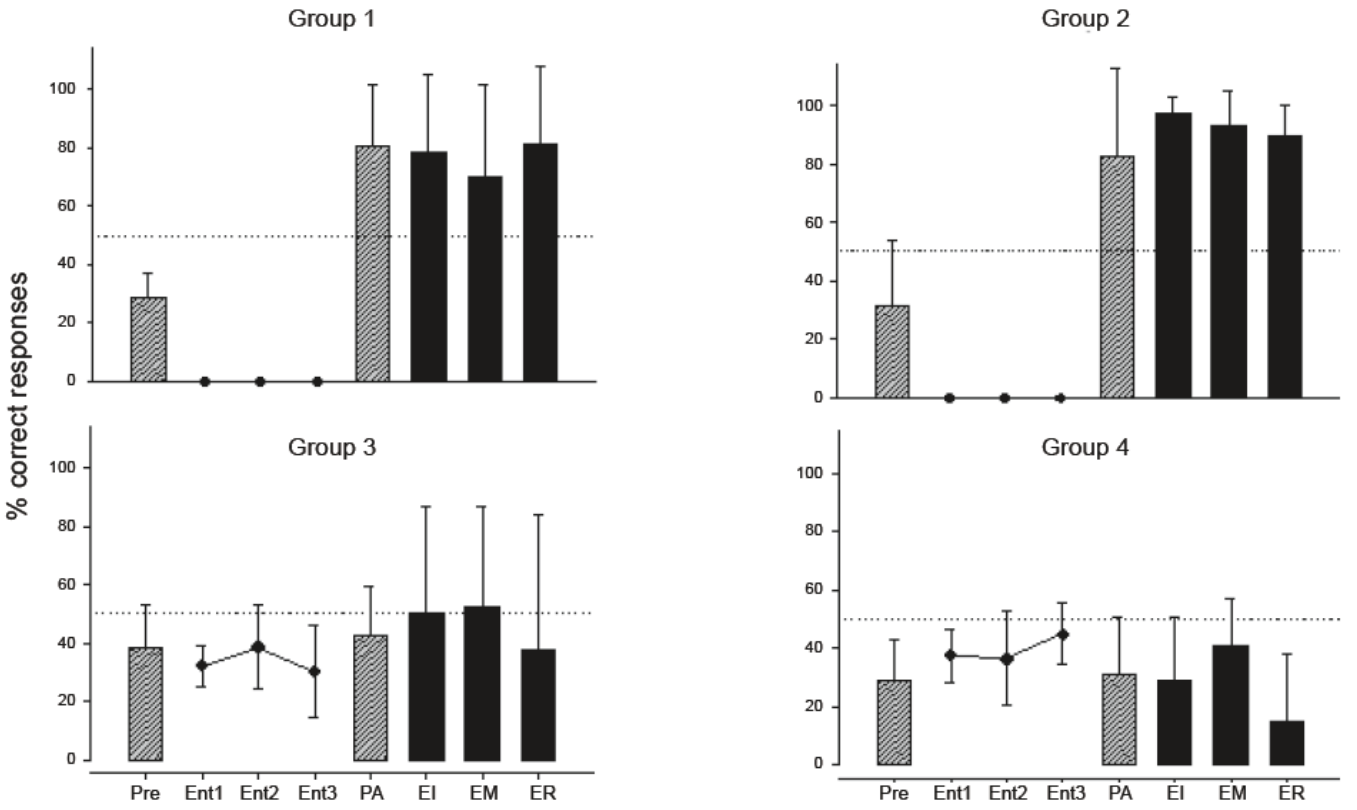


Figure 2. Percentage of correct responses per group in each of the tests to which they were exposed (Pre: pre-test, Ent1-3: Training1-3, LT: Learning test; EI: extra-instance test; EM: extra-modal test, ER: extra-relational test)

9 and 10 belonging to Groups 1 and 3, had the best performance, reaching 100% of correct answers. In contrast, participants 14 and 15, belonging to Group 2, showed the lowest performance levels reaching only a percentage of correct responses of 4% and 29%, respectively. Finally, in the transfer tests, only the participants 5 (Group 2) and 12 (Group 3) reached 100% of correct responses, even though in the learning test they had only achieved 62% and a 33% of correct responses, respectively.

Analysis of descriptions

To analyze the post-contact descriptions made by the participants of this study, the taxonomy proposed by Ortiz, González and Rosas (2008) was used. The authors point out that a contingency situation is made up of three components: a) a stimulus situation, b) the subject's response to the situation and c) its consequences. In addition, they attribute certain qualities to a description, such as: a) presence, b) relevance, c) specificity and d) pertinence. The description will be qualified as present if any or all of the components

that make up the contingency are mentioned (i.e., SE stimulus situation, R answer and C consequence), otherwise it will be classified as absent; when acquiring the quality of presence, the description can be qualified as relevant or irrelevant depending on whether the elements are, or not, directly related to the criteria specified in a contingency arrangement. If the description has been considered relevant, it can be classified as specific or generic; if all the relevant elements of the component in question are mentioned (SE, R and C), regardless of whether or not irrelevant elements are included, the description will be qualified as specific; on the other hand, if the mention of any of the relevant elements is missing, but at least one of them is mentioned, the description will acquire the generic value.

Thus, the more specific and pertinent a description is, the better it will identify the relationships between the components of a contingency arrangement and the criteria under which a response is selected by environmental consequences in the presence of certain stimuli and not others.

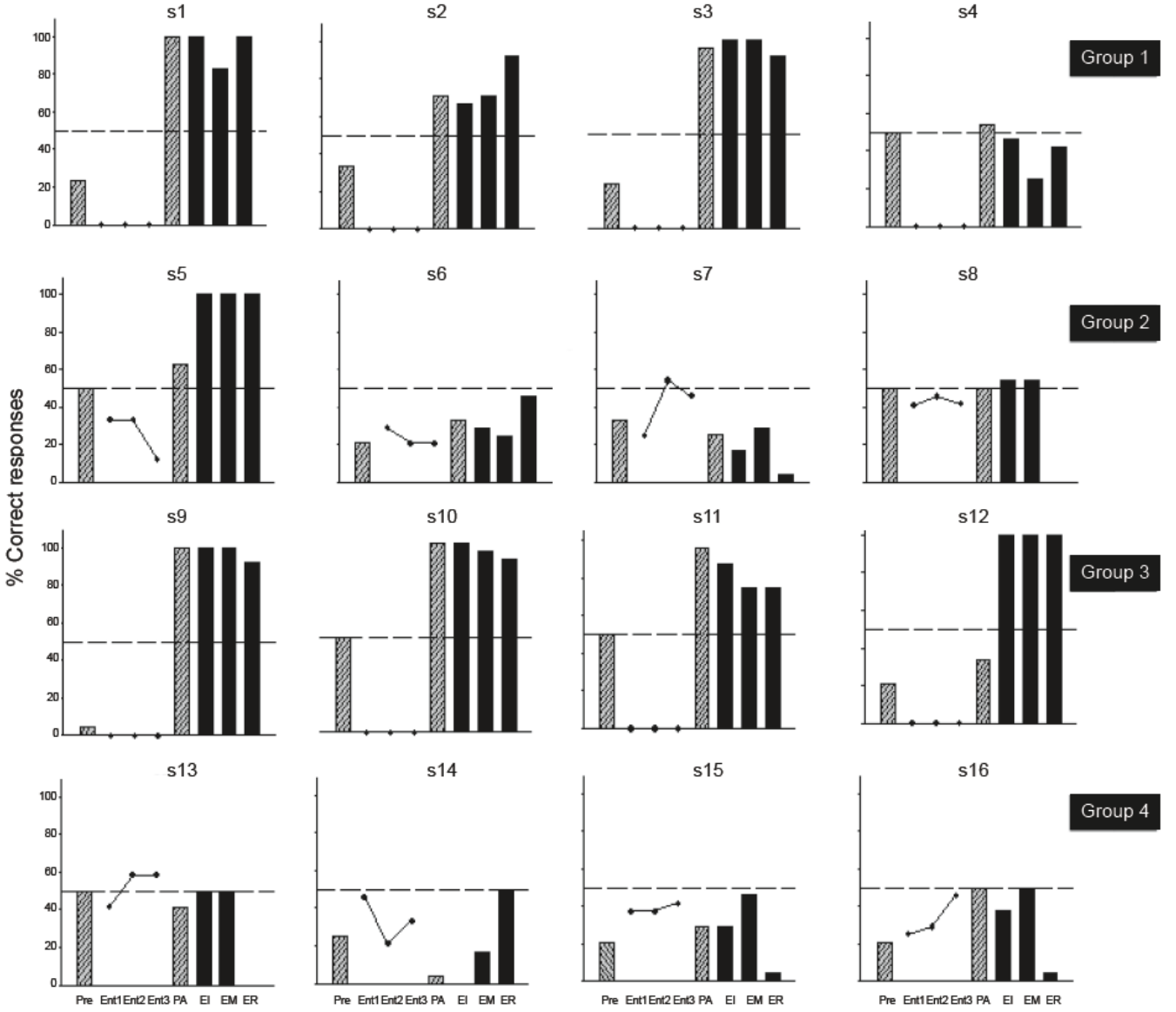


Figure 3. Percentage of correct responses by subject by group in each test and experimental phase.

Consequently, in the present study the descriptions related to the three components of the contingency situation were evaluated: stimulus (SE), response (R) and consequence (C) situation, analyzing whether each of them was absent or present was relevant or irrelevant, generic or specific, pertinent or not pertinent with respect to the situation that the participants faced[1].

1 It is important to mention that although the final descriptions are analyzed with respect to the three components of the contingency (SE, R, C), the emphasis is made, throughout the writing, on the descriptions corresponding to the Response (R) component. Since it is in this component that reference is made to the criteria used to solve the task, such descriptions could provide more information about the variables that exert control over the behavior.

Figure 5 shows the type of post-contact descriptions made at the end of the task with respect to each of the components described above indicating the percentage of subjects per group that made descriptions absent (A), irrelevant (I), generic and not pertinent (GNP), specific and not pertinent (ENP), generic and pertinent (GP) or specific and pertinent (EP).

Regarding the Stimulus Situation (SE) component, it can be observed that a high percentage of subjects in all the groups made generic and pertinent (GP) or specific and pertinent descriptions (EP), which means that most of the participants were able to recognize and describe several or all of the elements of the stimulus situation they faced. Related to the Response component (R), only the participants

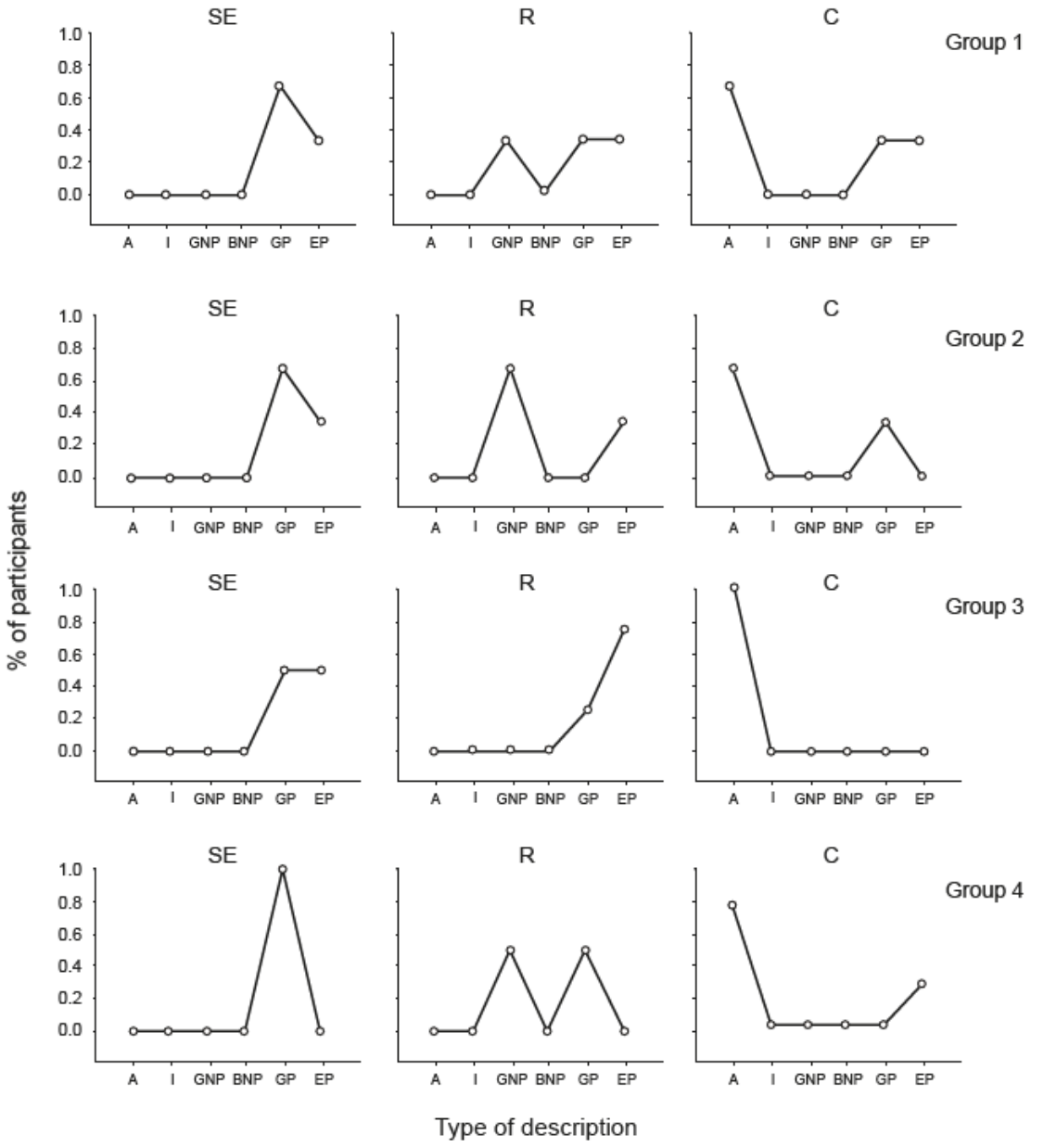


Figure 4. Percentage of participants whose post-contact descriptions were rated for each component of the contingency situation (i.e., Stimulus Situation-SE, Response-R and Consequence-C) as Absent (A), Irrelevant (I), Generic and not pertinent (GNP), Speci ic and not pertinent (ENP), Generic and pertinent (GP) or Speci ic and pertinent (EP).

of Group 3 (observational-description with 12 trials), with a high percentage (75%), made specific and pertinent descriptions, while the other 25% made descriptions that were rated as generic; these descriptions, qualified as pertinent, coincide with the high percentages of correct responses obtained by the participants of this group in the learning and transfer tests.

Three of the participants of Group 4 (instrumental-description with 12 trials) made generic descriptions that were not pertinent and the remaining 25% were pertinent. The elaboration of inaccurate post-contact descriptions of the participants in this group corresponds to the low percentages of correct responses in the learning and transfer

tests (none of the subjects that were in this group exceeded 50% of correct responses).

Even when two participants received the explicit request, like the other participants, neither subject 1 nor subject 7 (belonging to Groups 1 and 2, respectively) made any description; therefore, the percentages in these two groups were obtained only taking into account three participants. Thus, in Group 1 one participant made generic descriptions that were not pertinent (GNP), one more made a generic and pertinent description (GP), and another one, a specific and pertinent description (EP).

Meantime, two of three participants in Group 2 made descriptions rated as generic and not pertinent (GNP), while the rest of the descriptions were rated as specific relevant to the component in question. Finally, the component of consequence (C) tended to be absent from the descriptions elaborated by the participants of the four groups.

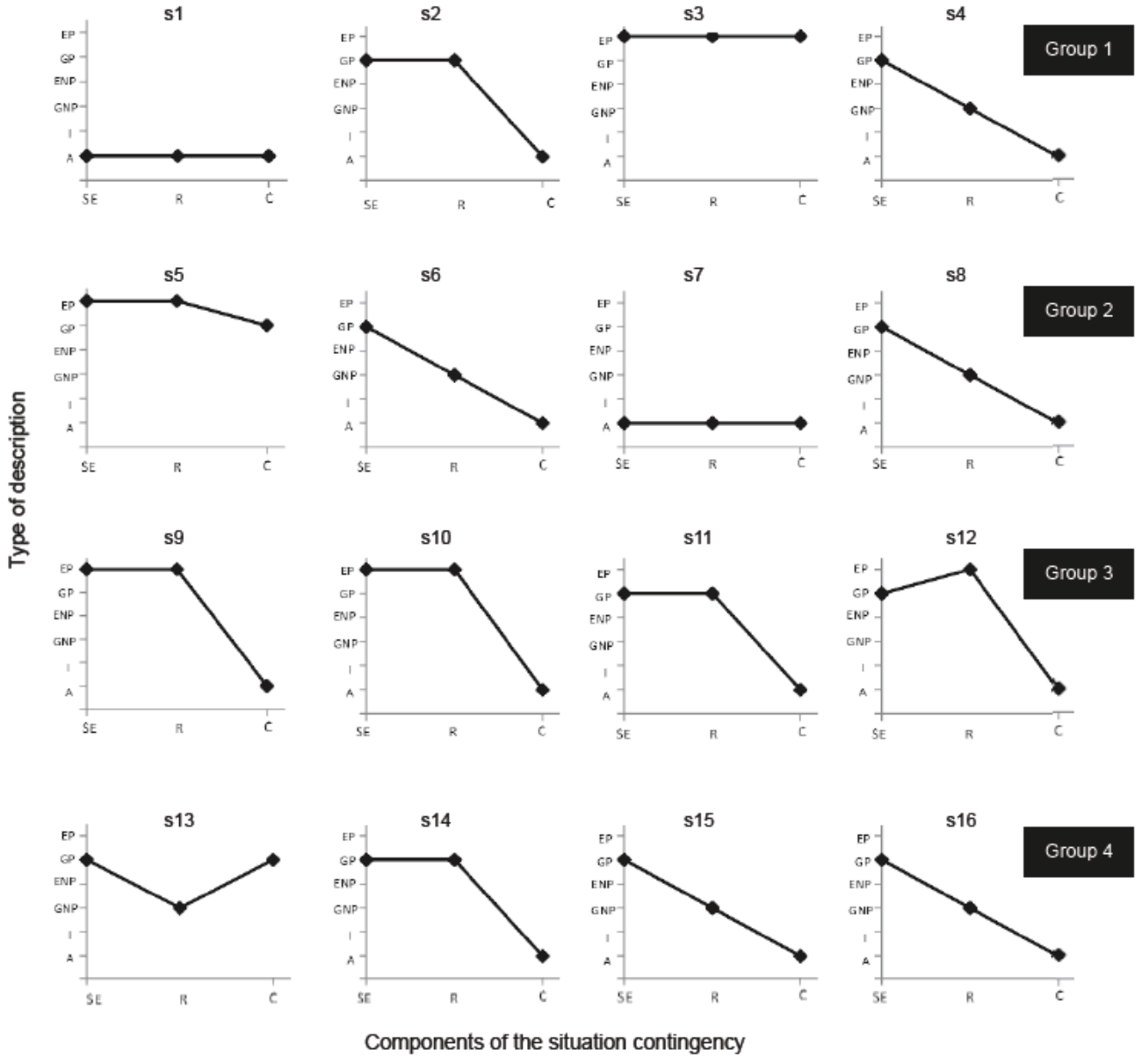


Figure 5. Type of post-contact descriptions by subject and by group, classified for each component of the contingency situation (Stimulus Situation, Response and Consequence) as Absent (A), Irrelevant (I), Generic not relevant (GNP), Specific not relevant (ENP), Relevant Generics (GP) or Relevant Specific (EP)

Figure 5 shows the type of post-contact descriptions made by each subject at the end of the task, evaluated with respect to each of the contingency components of the stimuli arrangement according to the criteria specified in the taxonomy proposed by Ortiz, González and Rosas (2008). Only participant 3, belonging to Group 1, made a specific post-contact description relevant to each of the components of the contingency situation. In correspondence with the type of description made, it can be observed that this subject achieved a high percentage of successes in learning and transfer tests. On the other hand, participant 2 in this same group elaborated a generic description relevant to the response component, which coincides with a performance higher than 70% of correct answers obtained in learning and 90% of correct answers in the last transfer test.

Similarly, there is a relationship between the type of descriptions made by subject 4 (Generic and not pertinent, GNP) which is considered poorly adjusted and the low percentage of correct responses obtained in the post-training tests. In Group 2, it can be observed that subject 5 made descriptions of the response component (R) qualified as specific and pertinent (EP), obtaining, at the same time, high percentages of correct responses in transfer tests. Subjects 6 and 7 made generic and pertinent (GP) descriptions related to the response component.

Three participants in Group 3 (participants 9, 10 and 12) made specific and pertinent descriptions regarding the component R, while subject 11 made a description for this component that was qualified as a GP (generic and pertinent).

Likewise, the descriptions elaborated by three of the participants of Group 4 (subjects 13, 15 and 16) were classified as generic and not relevant, that coincide with an individual performance of no more than 50% of correct responses in learning and transfer tests. In contrast, participant 14, belonging to this group, made a generic and pertinent description (GP) even though it did not exceed 50% of correct responses in learning and transfer tests.

Discussion

Regarding the relationship between the type of training and its effects on the matching response, the data show that participants who were exposed to observational training (Groups 1 and 3) achieved performances with the highest number of correct responses, both in learning and transfer tests. These data, in accordance with the findings of some authors (e.g., Ribes, Barrera & Cabrera, 1998, Vega & Peña, 2008), seem to support the assumption that exposing an individual to an observational training that allows him to make contact with the relationships that have been

stipulated as correct or incorrect according to a criterion (i.e. similarity, identity or difference), could lead to the control of behavior by the contingencies even without having to issue an explicit matching response.

Additionally, the findings of this study provide evidence that learning through observation can occur even if the observer is not directly exposed to the performance of another individual; thus, the learning of contingency relations can also occur in arrangements where reinforced responses are presented only graphically.

However, it is important to consider some specific factors related to the type of training that may be exerting control over behavior. In the present study, the contact time with the stimuli arrangement in which the choice was made and with the information on whether the response was correct or incorrect did not have a limit for the participants who were exposed to observational training. In contrast, for participants to whom an explicit response was required, immediately after they made their choice and received information about whether their response was correct or erroneous, the stimuli of the arrangement and the information on the relevance of the response disappeared from the screen, in order to start a new trial. Thus, for these individuals, the contact time with their own execution and the consequences thereof was reduced to a minimum. It is possible, then, that the time that the subjects are exposed to the contingency arrangement once the response has been issued and they have received information about whether the response has been right or wrong plays a relevant role in learning new relationships of dependence between the stimuli that make up a situation.

On the other hand, some authors e.g. (Irigoyen, Carpio, Jiménez, Silva, Acuña & Acuña, 2002; Ribes, 2000; Serrano, Garcia & López, 2009; Serrano, Flores, Peralta & Martínez, 2017; Vega & Peña, 2008) have suggested that exposure to both correct and incorrect instances in a situation may be important to facilitate the control of behavior due to contingencies. In accordance with this point of view, it is possible to assume that contact with different percentages of correct and incorrect responses during the training phase may have some effect on the participants' performance in learning and transfer tests. In this study it was found that while participants of the observational training groups (who had better performances in learning and transfer tests) were exposed to 68% of correct responses and 32% of incorrect responses regarding the total number of training trials (i.e., 72), while participants of the instrumental groups (who obtained a lower percentage of correct answers in the learning and transfer tests), obtained a percentage of correct responses less than 40% throughout the three phases of training. However, the performance of some participants

makes it difficult to establish more precisely the effect of this variable; even though participant 4, for example, was exposed to the same percentage of successes and errors as their peers belonging to the observational groups, his performance in learning and transfer tests was below 55% of correct responses.

By the same token, participant 5 who obtained only 26% of correct responses during training trials, reached 100% of correct responses in transfer tests. These discrepancies make it difficult to analyze the role that exposure can have to correct and erroneous instances in the control of contingencies over behavior. Although further research will be necessary to explore the role of this variable, an alternative could be the inclusion of coupled participants, which could ensure that subjects receiving observational training are exposed to the same percentage of correct and incorrect responses than those who are required to have an explicit matching response during this phase of the task.

Likewise, the percentage of correct responses and errors to which different participants are exposed during an observational training could be varied , using a methodology similar to that used by Silva, Cisneros and Ortiz (2014), which consisted of using pre-established performances (i.e., in terms of the total correct responses or the moment to moment choice) in order to identify whether the post-contact description made was modified from the knowledge of the result of a participant to whom supposedly, such a description was presented as instruction.

An interesting fact is found in the performances of participants 5 and 12, who showed levels under 50% of correct responses in the learning test and, nevertheless, they managed to obtain the total of correct responses in the three transfer tests. To explain such performance, it is possible to assume that, at first, only the sample and comparative stimuli have exerted control over the behavior of these participants. Since in the second order matching-to-sample tasks the matching criterion is specified by the sample stimuli, performance in transfer tests could have been favored by a late contact with such stimuli and the subsequent identification of the response criteria. However, the determining variables for this type of performance should be established in other experiments.

Regarding the elaboration of post-contact descriptions, the data suggest that the type of training used had an effect on the type of description formulated. As indicated above, participants in the observational groups were able to produce more pertinent and specific descriptions, while those from the remaining groups tended to elaborate more generic and less pertinent descriptions.

However, the descriptions elaborated by subject 4 (qualified as generic and not pertinent in the response component) who was exposed to observational training, and those elaborated by participant 5 (qualified as specific and pertinent) who was asked to give an explicit matching response during training suggests that, more than the type of training used, the accuracy of post-contact descriptions could depend on the performance itself (e.g., González & Ortiz, 2014, Guerrero-Radillo & Ortiz, 2007, Ortiz & Cruz-Alaniz, 2011; Ortiz & González, 2010b); thus, while participant number 4 had a low percentage of correct responses, participant 5 achieved 100% of correct responses in transfer tests. Additionally, with the exception of one participant, there was correspondence between the type of rules elaborated and the percentage of correct responses obtained. The above coincides with results described by Ribes (2000), who states that only effective performances in a given condition will allow the formulation of adequate rules as a product of prior contact with the properties of the stimuli that comprise it.

Regarding the role that the repeated elaboration of descriptions during training had on performance, it seems that this variable did not exert a substantial effect. In fact, data suggest that this type of requirement could interfere with the participant's performances when emitting an instrumental response (it was these participants who achieved a lower percentage of correct answers) and, in contrast, could facilitate the control of the response by the participants who have been exposed to observational training (participants in Group 3 were the ones who achieved the highest percentage of correct answers). However, the great similarity between the performance levels of participants in the observational groups and those belonging to the instrumental groups makes it difficult to establish the role that this variable could have on the behavior displayed in the matching- to-sample tasks.

Finally, it is important to mention that the results found in this experiment contrast with the data obtained from previous experiments using second order matching-to-sample task, in which it has been observed that participants manage to perform effectively in learning tests after being trained in an instrumental way (e.g., Ribes & Castillo, 1998, Ribes, Moreno & Martínez, 1995, Ribes, Torres & Ramírez, 1996, Ribes & Zaragoza, 2008). It is possible that this difference is due to the type of instructions used, to individual variables concerning the populations employed or to other uncontrolled factors. Thus, in subsequent research, the effort to identify variables that could exercise some control over the performance of this type of task will be of major importance to achieve greater generalization of the results.

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